



**United States Patent** [19]  
Kirchenbaum

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[54] **ELECTRICAL SOCKET CONNECTOR CONSTRUCTION**

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[52] U.S. Cl.: **229/19; 219/176 MP**

[56] Field of Search: **229/19; 176 MP; 222**

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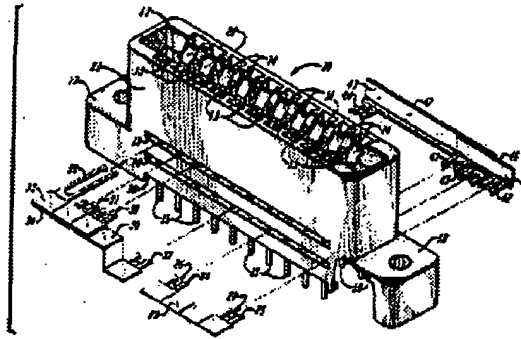
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[57] **ABSTRACT**

A socket connector (10) for printed wiring boards (17) in which signal or voltage connections may be made between the connector pins (14, 15) and the wiring board (17) is formed to present two longitudinal slots (19, 20) in either side wall (21, 22) of the connector housing (11) to provide access to the connector pins (14, 15). Electrically conductive strips (23, 24, 25, 26, 27, 28, 29, 30) having bifurcated tabs (31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, etc.) extending therefrom are fitted into the housing slots (19, 20), the tabs clamping the selected pins (14, 15) to make the electrical connections required. The four slots and the members of the connector housing make possible a number of pin interconnections combinations. Surface areas of the board are thus freed for other circuit purposes.

**7 Claims, 1 Drawing Figure**



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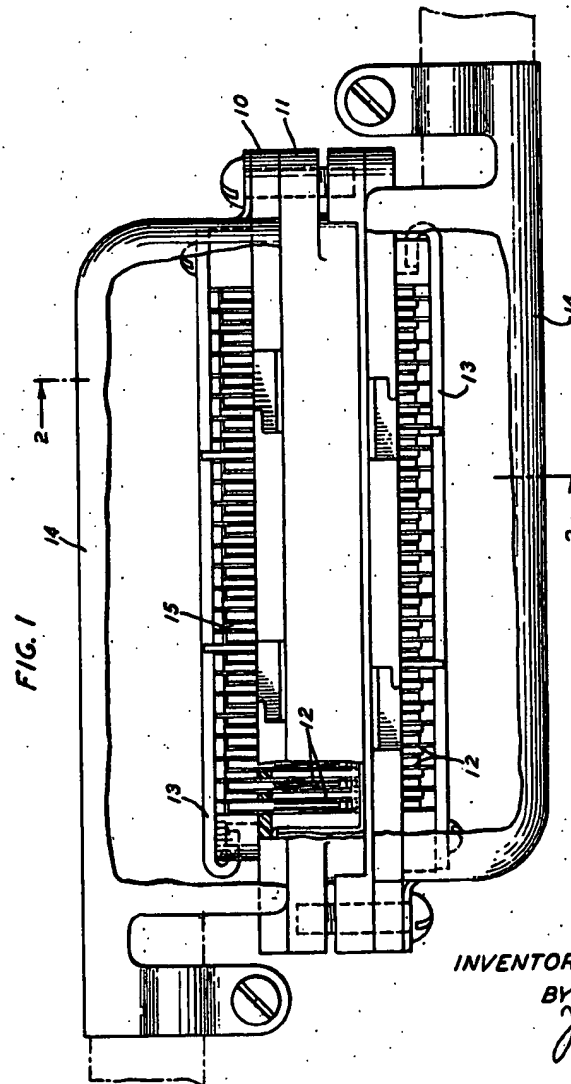
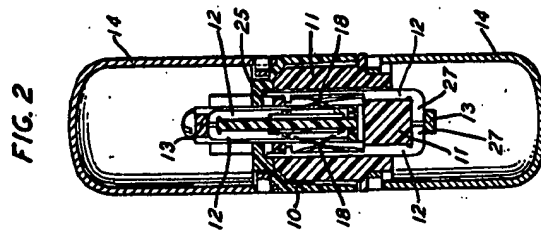
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C. KOWALESKI ET AL  
MULTIPLE CONDUCTOR CONNECTOR

3,155,446

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3 Sheets-Sheet 1



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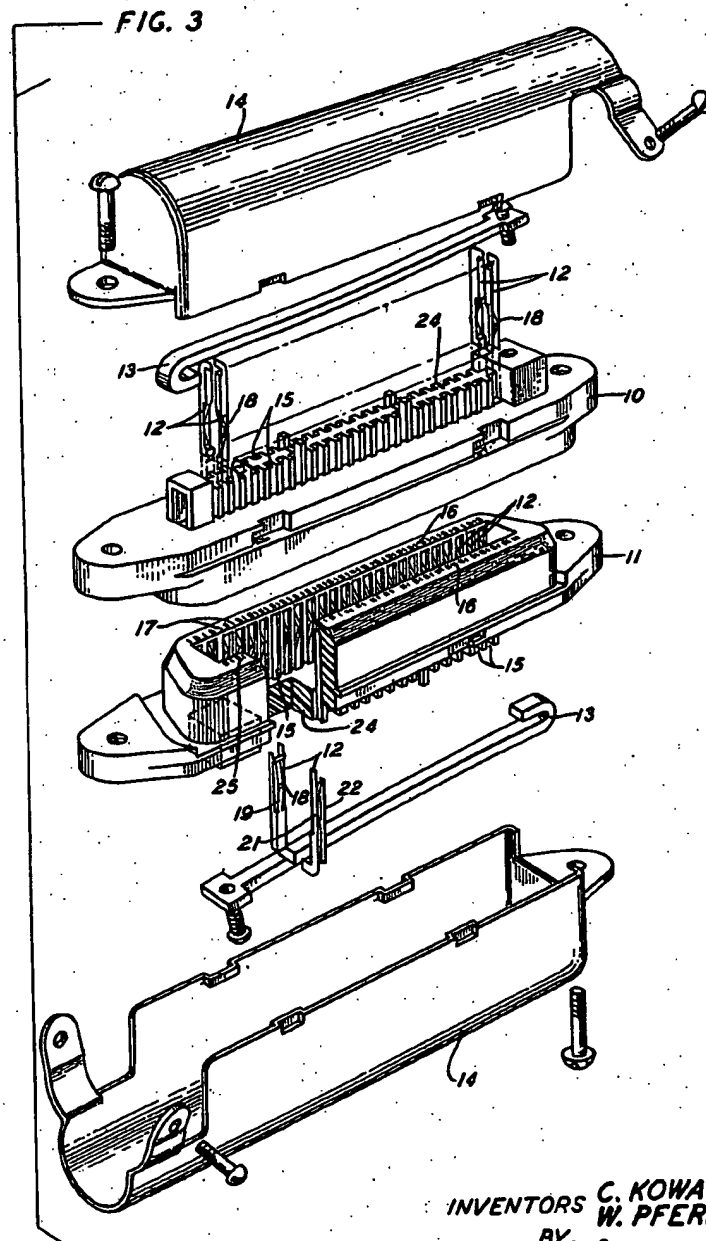
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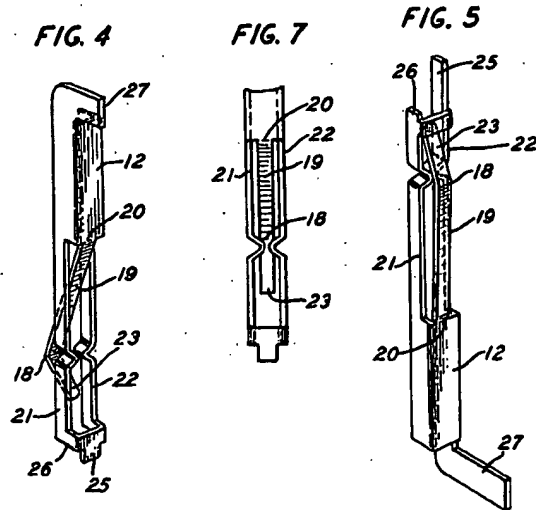
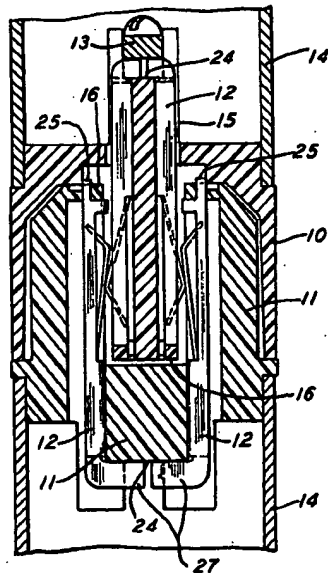


FIG. 6



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## MULTIPLE CONDUCTOR CONNECTOR

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This invention relates to electrical devices for making  
connections between electrical conductors and more spe-  
cifically to electrical devices having a multiplicity of re-  
movable and interchangeable electrical terminals.

One of the major economic factors in marketing an  
acceptable electrical connector is the human installation  
time and cost required to make, change, and remake elec-  
trical connections in the field. Connectors incorporating  
soldered junctures, screw or nut type terminals, nonre-  
movable terminals and the like may necessitate so many  
installer operations in making and remaking electrical con-  
nections that maintenance costs defeat any economic value  
of the terminal itself. Those connectors requiring soldered  
or crimped joints or including nonremovable electrical  
terminals may defeat entirely any field changes in elec-  
trical connections without the use of special tools or the  
complete replacement of the entire connector.

An object of the invention is to provide a multiple  
wire connector.

Another object of the invention is to provide a con-  
nector with removable and mutually substitutional ter-  
minals.

A still further object of the invention is to provide an  
electrical terminal of such shape as to facilitate field  
maintenance without fear of damaging the terminal.

A feature of the invention is the provision of a multiple  
wire connector with easily removable terminals.

Another feature of the invention is the provision of  
a multiple wire connector with removable terminals  
wherein the terminals may be removed and mutually in-  
terchanged in the field without the need of special tools  
or equipment.

Another feature of the invention is the provision of an  
electrical terminal being generally U-shaped in cross sec-  
tion throughout its entire length thereby being rigid and  
durable in structure.

A still further feature of the invention is the provision  
of an electrical terminal that can be permanently fas-  
tened to an electrical conductor but may be interchanged  
at will with any other terminal in a connector.

In accordance with the preferred embodiment of the  
invention, the invention comprises a two piece connector.  
Each piece includes an insulating block, a multiplicity of  
electrical terminals, a terminal retaining bar, and a con-  
nector hood or guard. The electrical terminals are gen-  
erally U-shaped in cross section throughout the entire  
length of the terminal. This type cross section provides  
structural rigidity and protects the terminal and spring  
contact during field maintenance. A cantilever spring  
originates on the bottom of the U-shaped cross section  
and is bent so that a portion adjacent the free end of the  
cantilever spring is projected outside of the sides of the  
U-shaped cross section. The free end is then reverse bent  
back towards and in between the two sides of the U-shaped  
cross section to protect the cantilever spring. The pro-  
jected portion of the cantilever spring forms a spring type  
contact surface. Each terminal includes restraining  
means on one end and fixing means on the other.

The terminals are inserted into rectangular slots in the  
insulating blocks through the rear surfaces of the latter.  
An appropriately located barrier ridge cooperates with  
the aforementioned restraining means to prevent relative  
motion between the terminal and the insulating block

both in directions parallel to and perpendicular to the  
axis of the terminal. The fixing means includes a tab  
projecting from the end of the terminal in such manner  
that it cooperates with the rear surface of the insulating  
block to regulate the insertion depth of the terminal in  
the insulating block.

The retaining bar fits over the fixing means (tab pro-  
jecting from the terminal) and fastens solidly to the in-  
sulating block's rear surface, thereby preventing acci-  
dental extraction of the terminals from the insulating  
block. Removal of the retaining bar by an installer or  
maintenance man provides access to the terminals and al-  
lows him to rearrange, alternate, or interchange any ter-  
minal in the block with another. The hood covers and  
protects the entire connector structure. Except for a  
screwdriver or other ordinary, readily accessible tools  
for removing the retaining bar and hood, no special tools  
or equipment are needed to make changes in the electrical  
connections.

A variation of this device is also apparent to those  
skilled in the art. If the terminals in one half of a two  
piece connector can be interchanged with each other in  
the same insulating block, it is obvious that the terminals  
in the other half of the connector may be permanently  
mounted in their insulating block without destroying the  
feature of complete electrical connection interchange-  
ability. This is also contemplated in this invention by  
providing a permanent restraining means on the electrical  
connectors in one of the two insulating blocks.

The invention will be more clearly understood from the  
following detailed description, when read in conjunction  
with the drawing, in which:

FIG. 1 is an elevation view of the connector showing  
the respective locations of the various elements;

FIG. 2 is a cross sectional view taken approximately  
along the line 2-2 of FIG. 1 and shows the contacting  
of the electrical terminals of the two insulating blocks;

FIG. 3 is an isometric exploded view of the connector  
and indicates the assembly of the device;

FIG. 4 is an isometric view of one of the electrical  
terminals;

FIG. 5 is an inverted isometric view of a variation of  
one of the electrical terminals;

FIG. 6 is an enlarged cross-sectional view indicating  
the relative positions of the terminals within the insulating  
blocks, the contacting of the terminals, and the coopera-  
tion of the retaining bar, terminals, and insulating block;

FIG. 7 is an enlarged view of a part of an electrical  
terminal showing the indentations of the sides of the  
U-shaped cross section underneath the projected canti-  
lever spring.

According to the invention as depicted by the various  
figures, the connector comprises two insulating blocks 10  
and 11, a multiplicity of electrical terminals 12, terminal  
retaining bars 13, and connector hoods or guards 14.

The insulating blocks 10 and 11 have rectangular slots  
15 (see FIG. 3) extending from the rear surfaces 24 of  
the insulating blocks 10 and 11 to an appropriately lo-  
cated barrier ridge 16 adjacent the front surfaces of the  
blocks 10 and 11. Rectangular openings 17 in the bar-  
rier ridge 16 extend through the barrier ridge 16 and into  
the rectangular slots 15. Each rectangular slot 15 is  
shaped to receive an electrical terminal 12.

The electrical terminals 12 are generally U-shaped in  
cross section, as shown in FIGS. 4 and 5, and have canti-  
lever spring type contacts 18. The U-shaped or channel  
cross section was chosen to lend rigidity to the electrical  
terminals 12. Since one of the objects of this connector  
is to provide a structure that lends itself to field main-  
tenance, a rigid resilient structure was deemed necessary.  
It will be noted that the U-shaped cross section is main-

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tained throughout the entire length of the electrical terminals 12 to fulfill this object. A cantilever spring 19 originates from the bottom 20 of the U-shaped cross section and is bent at an angle to project a portion 18 of the cantilever spring 19 outside of the two sides 21 and 22 of the U-shaped cross section. The free end 23 of the cantilever spring 19 is reverse bent back towards and in between the two sides 21 and 22 of the U-shaped cross section. The two sides 21 and 22 of the U-shaped cross section are indented towards the center of the U-shaped cross section under the projected portion 18 of the cantilever spring 19, as shown in FIG. 7. The indentations close the channel section to a degree narrower than the width of the cantilever spring 19, thereby preventing the cantilever spring 19 from being forced back in between the two sides 21 and 22 of the U-shaped cross section. Electrical contact is insured and overstraining of the contact 18 prevented by the indentations.

Restraining means are located on one end of each electrical terminal 12 and comprise in this instance a tab 25 adjacent a shoulder 26. On the other end fixing means are located which, in this instance, include a side-wise projection 27.

The connector is assembled by introducing the electrical terminals 12 into the rectangular slots 15 through the rear surfaces 24 of the insulating blocks 10 and 11. The end of the terminals 12 with the restraining tabs 25 are inserted first. Each terminal is progressed into the slot 15 until the restraining tab 25 mates with a rectangular opening 17 in the barrier ridge 16 and the restraining shoulder 26 butts against the barrier ridge 16. The cooperation between the restraining shoulder 26 and the barrier ridge 16 prevents relative motion between the terminal 12 and the insulating block 10 or 11 in a direction parallel to the axis of the terminal 12. The cooperation of the restraining tab 25 with a rectangular opening 17 and the slot 15 with the electrical terminal 12 prevents relative motion between the terminal 12 and the insulating block 10 or 11 in directions perpendicular to the axis of the terminal 12. The fixing tab 27 comes in contact with the rear surface 24 of the insulating blocks 10 or 11 when the restraining tab 25 and the restraining shoulder 26 come into contact with a rectangular opening 17 and the barrier ridge 16.

The retaining bar 13 is then fixed to the insulating block 10 or 11. The retaining bar 13 operatively contacts the fixing or sidewise projecting tab 27 of the electrical terminals 12 and secures the terminals 12 in the insulating blocks 10 or 11. The hood or guard 14 is then placed over the retaining bar 13 and secured to an incoming cable and the insulating block 10 or 11. The guard covers and protects the retaining bar 13 and terminals 12 with their associated wires. The interconnections between the wires of the incoming cable and the connector terminals 12 are not part of the invention but it is suggested that such interconnections can be made either by soldering, crimping of the wire between the sides of the terminal or other like means. The insulating block 10 can then be mated with the insulating block 11, thereby electrically interconnecting the electrical terminals 12 of the insulating block 10 with those of the insulating block 11.

It is to be noted that an installer or maintenance man can make, remake, or alternate any pair of electrical interconnections in the connector by simply removing the hood 14 and retaining bar 13 of either half of the connector. The electrical terminal 12 is extracted from its rectangular slot 15 and interchanged or placed into another slot 15 in the insulating block 10 or 11. This operation can be accomplished in the field using ordinary tools, i.e., a screwdriver or the like, and can be done without separating the two insulating blocks 10 and 11.

In accordance with the variation of this device aforementioned wherein the terminals 12 in one insulating block 10 and 11 are permanently fixed in the block, the

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terminals 12 may be easily permanently fixed in an insulating block 10 or 11 by using the variation of the terminal 12 as suggested by FIG. 5. The restraining tab 25 is lengthened so that when the terminal 12 is fully inserted into a rectangular slot 15, the tab 25 will extend through the rectangular opening 17 and beyond the barrier ridge 16. The extended tab can then be bent over, thereby preventing the terminal 12 from being extracted from the insulating block 10 or 11.

The use of an extended tab 25 as explained above dispenses with the necessity of using a retaining bar 13 as none is needed to retain the terminals 12 in the insulating block 10 or 11. Terminals 12 inserted and fixed in an insulating block 11 in this fashion are shown in FIG. 6.

It is obvious that the invention is not limited to the specific structure illustrated and that it may be employed in many ways too numerous to mention by those skilled in the art. Such use is within the scope of the appended claims.

What is claimed is:

1. A multiple wire connector comprising a mating pair of insulating blocks including a multiplicity of removable electrical terminals in each of said blocks, and a retaining bar associated with at least one of said blocks, said terminals contained in one block being in electrical contact with the terminals in the other, said terminals having spring contact surfaces and being generally U-shaped in cross section throughout the entire length of said terminals, the latter having cantilever springs originating at a point intermediate the ends of said terminals on the bottom of the U-shaped section and bent at an angle to project outside of the U-shaped section thereby forming the spring contact surface, the free end of said cantilever spring bent back towards and into the U-shaped section to protect the cantilever springs, both sides of the U-shaped cross section indented towards the center of the section in a portion under the projected spring, said indentations closing the cross section to a degree narrower than the cantilever spring thereby preventing the spring from being forced down in between the sides of said section, said terminals having restraining means on one end and fixing means on the other, said latter means clamped to said blocks by said bars preventing extraction of said terminals from said blocks.

2. A multiple wire connector according to claim 1 wherein said mating pair of insulating blocks each have front and rear surfaces; by removing said bars said terminals are removable, interchangeable and insertable in the blocks through said rear surfaces without separating said blocks and without disturbing the electrical connections between the other terminals in said mating blocks.

3. A multiple wire connector according to claim 2 wherein said terminals are contained in compartments in said blocks and said fixing means comprises a sidewise projection on one end of the terminal, said projection in contact with the rear surfaces of the insulating blocks and clamped to the latter by bar to prevent extraction of the terminals from the insulating blocks.

4. A multiple wire connector comprising an insulating block having front and rear surfaces, said block including a multiplicity of removable electrical terminals and a retaining bar associated with said block, said terminals having spring contact surfaces and being removable and insertable in said insulating block through the rear surface, said terminals being generally U-shaped in cross section throughout their entire length and having cantilever springs originating at a point intermediate the ends of said terminals on the bottom of the U-shaped section and bent at an angle to project outside of the U-shaped section thereby forming the spring contact surfaces, the free end of said cantilever spring bent back towards and into the U-shaped section to protect the cantilever springs, both sides of the U-shaped cross

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section indented toward the center of the section in a portion under the projected spring, said indentations closing the cross section to a degree narrower than the cantilever spring thereby preventing the spring from being forced down in between the sides of said section, said terminals having restraining means on one end and fixing means on the other, the latter means clamped to said block by said bar thereby preventing extraction of said terminals from said block.

5. A multiple wire connector according to claim 4 wherein said insulating block has in its front surface an elongated rectangular trough with compartments in the long side walls of said trough to contain the terminals, said compartments comprising a rectangular slot extending from an opening in the rear surface of the insulating block to a barrier ridge adjacent the front surface of said insulating block, said barrier ridge including apertures to cooperate with the restraining means of the terminals, said last named means further comprising a projection and a shoulder on one end of said terminals, said apertures shaped to admit said projections and to allow said shoulder to butt against said ridge.

6. A multiple wire connector according to claim 4 wherein said insulating block has a base portion with front and rear surfaces and an elongated rectangular projection on a plane perpendicular to the front surface of said portion, said projection including compartments in the long walls of the projection in which are contained the electrical terminals, said compartments comprising a rectangular slot extending from an opening in the rear surface of the portion of the block to a barrier ridge adjacent the end of said projection, the ridge including apertures to cooperate with the restraining means

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of the electrical terminals, said last named means further comprising a projection and a shoulder on one end of said terminals, said apertures shaped to admit said projections and to allow said shoulder to butt against said ridge, said fixing means in contact with the rear surface of said portion when said shoulder butts against said ridge thereby preventing relative movement of the electrical terminals with respect to the insulating block.

7. An electrical terminal comprising a metallic body having a spring contact surface and being generally U-shaped in cross section throughout its entire length, said terminal having a cantilever spring originating at a point intermediate the ends of said terminal on the bottom of the U-shaped section and being bent at an angle to project outside of the U-shaped section thereby forming the spring contact surface, the free end of said cantilever spring bent back toward and into the U-shaped section to protect said spring, both sides of the U-shaped cross section indented towards the center of the section in a portion under the projected spring, said indentations closing the cross section to a degree narrower than the cantilever spring thereby preventing the spring from being forced down in between the sides of said section, said terminal having restraining means on one end and fixing means on the other.

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